

**CLAIMS**

What is claimed is:

- 1 1. A method for forming a write head having an air bearing surface (ABS),  
2 comprising:  
3 forming a flux shaping layer;  
4 forming a pole tip layer on the shaping layer, the shaping layer being for focusing  
5 flux to the pole tip layer;  
6 forming a mask layer above the pole tip layer, the mask layer being more resistant  
7 to milling than the pole tip layer;  
8 forming a layer of resist above the mask layer;  
9 patterning the resist, the patterned resist defining about a maximum width of the  
10 pole tip in a direction parallel to the ABS of the head;  
11 removing portions of the mask layer not covered by the patterned resist;  
12 milling for shaping a pole tip from the pole tip layer;  
13 depositing a layer of dielectric material above the pole tip and flux shaping layer,  
14 wherein the layer of dielectric material extends about adjacent to the mask  
15 layer;  
16 depositing a stop layer over the dielectric material, the stop layer abutting the  
17 mask layer;  
18 polishing for forming a substantially planar upper surface consisting of the mask  
19 layer and stop layer;

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20 forming a gap layer above the pole tip to a desired thickness; and  
21 forming a trailing shield above the gap layer.

1 2. A method as recited in claim 1, wherein the pole tip layer is laminated.

1 3. A method as recited in claim 1, wherein the portions of the mask layer not  
2 covered by the patterned resist are removed by reactive ion etching.

1 4. A method as recited in claim 1, wherein the mask layer is formed of a material  
2 selected from a group consisting of carbon, a silicon nitrate, a tantalum oxide, a  
3 silicon oxide, and durimide.

1 5. A method as recited in claim 1, wherein the mask layer is formed of a material  
2 selected from a group consisting of  $\text{Si}_3\text{N}_4$ ,  $\text{Ta}_2\text{O}_5$ ,  $\text{SiO}_2$ , and durimide.

1 6. A method as recited in claim 1, wherein the mask layer is formed of carbon  
2 formed by filtered cathodic arc (FCA) deposition.

1 7. A method as recited in claim 1, wherein the mask layer is a multilayer structure.

1 8. A method as recited in claim 7, wherein the mask layer comprises at least one  
2 layer of carbon and at least one layer of durimide.

- 1 9. A method as recited in claim 1, wherein the pole tip layer is shaped to taper  
2 together towards the shaping layer along a plane perpendicular to the ABS.
- 1 10. A method as recited in claim 1, further comprising removing the mask layer prior  
2 to forming the gap layer, and forming dishing in the pole tip.
- 1 11. A method as recited in claim 10, wherein the mask layer is removed by additional  
2 polishing.
- 1 12. A method as recited in claim 10, wherein the mask layer is removed by etching.
- 1 13. A method as recited in claim 10, wherein the dishing is formed by etching.
- 1 14. A method as recited in claim 1, wherein the polishing is chemical mechanical  
2 polishing with a slurry selective to the dielectric material.
- 1 15. A method as recited in claim 1, further comprising forming a coil structure behind  
2 the trailing shield with respect to the ABS.
- 1 16. A method as recited in claim 1, further comprising forming a return pole above  
2 the trailing shield.
- 1 17. A method as recited in claim 1, wherein the head is a perpendicular head.

1 18. A method for forming a write head having an air bearing surface (ABS),  
2 comprising:  
3 forming a flux shaping layer;  
4 forming a pole tip layer on the shaping layer, a mask layer being formed above  
5 the pole tip layer;  
6 shaping a tapered pole tip from the pole tip layer;  
7 depositing a layer of dielectric material above the pole tip and flux shaping layer,  
8 wherein the layer of dielectric material extends about adjacent to the mask  
9 layer;  
10 depositing a stop layer over the dielectric material, the stop layer abutting the  
11 mask layer;  
12 polishing for forming a substantially planar upper surface consisting of the mask  
13 layer and stop layer; and  
14 forming a gap layer above the pole tip to a desired thickness.

1 19. A method as recited in claim 18, wherein the pole tip layer is laminated.

1 20. A method as recited in claim 18, wherein the portions of the mask layer not  
2 covered by the patterned resist are removed by reactive ion etching.

- 1    21.    A method as recited in claim 18, wherein the mask layer is formed of a material  
2           selected from a group consisting of carbon, a silicon nitrate, a tantalum oxide, a  
3           silicon oxide, and durimide.
- 1    22.    A method as recited in claim 21, wherein the mask layer is a multilayer structure  
2           formed of at least two of the materials selected from the group consisting of  
3           carbon, a silicon nitrate, a tantalum oxide, a silicon oxide, and durimide.
- 1    23.    A method as recited in claim 18, further comprising removing the mask layer  
2           prior to forming the gap layer, and forming dishing in the pole tip.
- 1    24.    A method as recited in claim 23, wherein the mask layer is removed by  
2           overpolishing.
- 1    25.    A method as recited in claim 23, wherein the mask layer is removed by etching.
- 1    26.    A method as recited in claim 23, wherein the dishing is formed by etching.
- 1    27.    A method as recited in claim 18, wherein the polishing is chemical mechanical  
2           polishing with a slurry selective to the dielectric material.

1 28. A method as recited in claim 18, further comprising forming a trailing shield  
2 above the gap layer and forming a coil structure behind the trailing shield with  
3 respect to the ABS.

1 29. A method as recited in claim 18, further comprising forming a trailing shield  
2 above the gap layer and forming a return pole above the trailing shield.

1 30. A method as recited in claim 18, wherein the head is a perpendicular head.

1 31. A method for forming a write head having an air bearing surface (ABS),  
2 comprising:  
3 forming a flux shaping layer;  
4 forming a pole tip layer on the shaping layer, a mask layer being formed above  
5 the pole tip layer;  
6 shaping a tapered pole tip from the pole tip layer;  
7 depositing a layer of dielectric material above the pole tip and flux shaping layer,  
8 wherein the layer of dielectric material extends about adjacent to the mask  
9 layer;  
10 depositing a stop layer over the dielectric material, the stop layer abutting the  
11 mask layer;  
12 polishing for forming a substantially planar upper surface consisting of the mask  
13 layer and stop layer;  
14 removing the mask layer;

- 15 forming dishing in the pole tip;
- 16 forming a gap layer above the pole tip to a desired thickness; and
- 17 forming a trailing shield above the gap layer.

1 32. A magnetic storage system, comprising:  
2 magnetic media;  
3 at least one head having:  
4 a reading portion for reading from the magnetic media; and  
5 a writing portion for writing to the magnetic media, the writing portion  
6 having been formed according to the method of claim 1;  
7 a slider for supporting the head; and  
8 a control unit coupled to the head for controlling operation of the head.

1 33. A magnetic storage system, comprising:  
2 magnetic media;  
3 at least one head having:  
4 a reading portion for reading from the magnetic media; and  
5 a writing portion for writing to the magnetic media, the writing portion  
6 having been formed according to the method of claim 16;  
7 a slider for supporting the head; and  
8 a control unit coupled to the head for controlling operation of the head.

1 34. A magnetic storage system, comprising:

- 2 magnetic media;
- 3 at least one head having:
  - 4 a reading portion for reading from the magnetic media; and
  - 5 a writing portion for writing to the magnetic media, the writing portion
  - 6 having been formed according to the method of claim 31;
- 7 a slider for supporting the head; and
- 8 a control unit coupled to the head for controlling operation of the head.